PETERSON BUILDERS , INC.

Labor Standards Application Program

Phase IV - FY-83

Electrical Trade Area

FINAL REPORT

TASK ES-8-19

Submitted to:

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This project is managed and cost-shared by Peterson Builders, Inc. for the National Shipbuilding Research Program. The program is a cooperative effort of the Maritime Administration's Office of Advanced Ship Development, the U.S. Navy, the U.S. shipbuilding industry, and selected academic institutions.

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FINAL REPORT

1. PROGRAM OBJECTIVE

This Report describes the participation of Peterson Builders, Inc. in the Maritime Administration (MarAd) National Shipbuilding Research Program for FY-83 to implement labor standards during ship construction towards controlling production costs in the electrical trade area for both shop work and installation work aboard ship. The overall objective of this Research Program is to reduce the cost of building ships. The objective of this specific project in the electrical trade area was to improve planning, scheduling, production control, and worker productivity through the application of labor standards, and thereby reduce the cost of electrical work in the shop as well as electrical installation work aboard ship. The goal of PBI has been, and continues to be, the construction of quality ships in less time, at ***less*** cost, and on schedule. This FY-83 program for implementing labor standards in the electrical trade area was recognized as a positive and direct contribution toward achieving this goal, while concurrently satisfying the program objective described above. This commonality of purpose supports PBI involvement in this Research Program.

2. PROJECT CONCEPTUAL PLAN

The PBI proposal for this project lists six major tasks intended for accomplishment during this program. These tasks outlined the general commitments considered necessary to provide a workable and successful program for implementing labor standards. The listing that follows briefly describes these tasks, which cover a broad range of effort.

Task A - Develop procedures, charts, and other forms for presenting labor standards information at a level of detail suitable for use by planners and schedulers in applying labor standards to actual production work.

Task B - Determine non-process factors in each area of concern.

Task C - Train planners and schedulers in techniques for applying labor standards.

Task D - Instruct supervisors on the purpose and application of labor standards.

Task E - Develop a system to monitor the currentness of labor standards.

Task F - Write a final report summarizing program success/failure, productivity and cost savings attainable, and related conclusions.

The format used for developing labor standards data prior to the FY-83 program was the H.B. Maynard Work Management Manual (WMM) which served as a guide to the process of obtaining and documenting standard data. Each of the ten sections of the WMM identified specific data covering the conditions that occurred on the job. In conjunction with the WMM, the Maynard Operational Sequence Technique

(MOST) was the system used to process the standard data. The wor methods involved in each area of concern were identified, and lab time was assessed to each of them.

The FY-83 MarAd program commitment was to implement labor standard in the areas for which labor standard data had already been developed during the FY-81 and FY-82 programs. Before the actual start of the FY-83 program, the need for a more detailed plan that would direct efforts to implement labor standards and accomplish objective of the FY-83 program was evident. This plan was devised by PBI, and was termed the MarAd Project General Approach. The p would: (1) list the phases that had to be accomplished; (2) state the objectives to be met during each phase; (3) provide a procedur step-by-step plan of action and sequence for carrying out each phase; and (4) make it possible to establish schedules leading to completion of the phases and the project on time.

The development of each phase would consist of: (a) a written statement of the objective of that phase; (b) a detailed plan of action; (c) the actual implementation of the plan of action to accomplish the given objective; and (d) a follow-up report of results, problems, and actions taken or needed to improve conditio and achieve the goals of the overall project.

One further breakdown was necessary before proceeding with this project. This involved the classification of electrical work into the three categories shown below, which would facilitate the

establishment of labor standards and their subsequent application to production work.

2.1 Cable Processing

- Cable Cutting
- Cable Pulling
- Cable Banding
- Preparation and Application of Identification Tags

2.2 Equipment Processing

- Preliminary Work in the Shop
- Equipment Mounting
- Equipment Hookup
- Testing

2.3 Miscellaneous

- Packing Multi-Cable Transits (MCT)
- Shooting Studs
- Miscellaneous Work

3. METHODOLOGY

The specific approach used during this project is described below, and consists of nine phases. These phases are first listed, and are then described individually in detail.

Phase I - Validate Electrical Labor Standard Data

Phase II - Establish Baseline Data

Phase III - Determine Non-Process Factor

Phase IV - Develop Labor Standard Process Sheets

Phase V - Implement Computer Assistance for Labor Standards Application

Phase VI - Train Planners and Schedulers

Phase VII - Instruct Electrical Supervisors

Phase VIII - Apply Labor Standards

Phase IX - Analyze Variances from Baseline Data

The four-step development approach was used with each of the nine phases. The following is a full four-step description of Phases I - Ix.

3.1 Phase I - Validate Electrical Labor Standard Data

3.1.1 Objective

The objective of this phase was to validate electrical labor standard data developed during FY-81 and FY-82.

3.1.2 Plan of Action

The first step was to validate previously established methods in the electrical trade area, which were developed about three years ago, and determine whether the associated labor standard data were still valid. This phase would also identify any new methods employed in this area.

Labor standard data would be validated using such techniques as time studies and spot sampling of current methods in actual use by the workers. Observed methods would be recorded and compared with the methods

previously established through use of the MOST system. Charts and data in the wMM would be updated as necessary to reflect current practices and conditions. Interference and non-process delays would be noted, reviewed, and categorized.

3.1.3 Implementation of Plan of Action

The detailed plan of action was executed as intended. Yard supervisors and industrial engineering personnel. worked closely together to ensure that the methods being employed were necessary, and were representative of work done under normal working conditions in the shop and aboard ship. Several changes were encountered, as reported below.

° Cable Cutting

Previous cable cutting had shown that one person could handle cable cutting for sizes 3/4″ O.D. and under, with two people needed for sizes over 3/4″ O.D. A change in the method occurred when an auto-toiler was manufactured in-house and installed, making this operation a one-man job for all cable sizes. The auto-toiler reels in cut cable in the same sequence as that needed for cable pulling, which reduces the set up time to sort cables before pulling, and also reduces the area needed to store cables prior to pulling. This change reduced the standard time from 0.604 hours to 0.238 hours for all cable sizes, including those over 3/4″ O.D., for a reduction of 0.366 hours per cable.

° Cable Pulling

Crew size for cable pulling depends on the length of cable, the number of bulkheads through which the cable passes, and restrictive conditions in the compartments through which the cable is run. The largest average crew size previously encountered on former PBI contracts had been six workers. Method evaluation disclosed that there could be circumstances where more or fewer workers would make up the most efficient crew size for cable pulling. A standard crew size of eight workers was established for the conditions that existed during this investigation.

° Cable Banding

A change in the type of band used to strap cable to hangers was made during the FY-82 program, but was not implemented pending consumption of bands in stock. The new type of band is currently being utilized, is less costly than the old band, because it is faster to install and remove. The new band is quickly installed or removed with a screwdriver or wrench, and is reusable if removed, whereas the old band had to be scrapped after removal.

° Preparation and Application of Identification Tags

Previously identification tags had been attached to the cable after the pulling operation. A change was made to apply the tags during the pulling operation. No changes were made in preparing the tags.

° Preliminary Work in the Shop

No changes were encountered with stuffing tubes, etc.

" Equipment Mounting

No changes were encountered in the mounting of boxes, panels, switches, lights, etc.

° Equipment Hookup

Some of the previous data for hookup of cables to panels, terminals, etc. was acceptable for commercial ships, but not for Navy Ships. Some updating was necessary, particularly in regard to the extra length of cable left inside the panel. Changes were made in the time standards charts for sizes over 23 circular roils. Charts are now arranged to suit calculations for small, medium, and large sizes of enclosures.

° Packing Multi-Cable Transits (MCT)

Cables passing through watertight bulkheads require MCT'S, which are square or rectangular housings through which the cables pass. Sealant inside the MCT prevents the passage of water into the next compartment. This operation was verified as a two-man job since two sets of hands are needed to line up the cables, inserts, and stay plates, which are imbedded in sealant that holds the cables in position.

° Shooting Studs

The PBI standard as validated remains the same. Changes in methods that require a different time base have been updated in the labor standards pick off charts. The intent of the validation process was to update methods.

The process was worthwhile, because the data now reflects current conditions, and the time values represent attainable targets for the worker to do the job.

METHODOLOGY

3.2 PHASE II - ESTABLISH BASELINE DATA

3.2.1 Objective

The objective of this phase was to obtain baseline data for actual working conditions prior to the application of labor standards.

3.2.2 Plan of Action

The first step was to design daily work sheets to document performance data on Cable Processing, Equipment Processing, Local Cables and Packing MCT'S, and Lighting SYStemS (Appendices A-D) . The second step to establish baseline data was to obtain the performance data from the worker who would use the sheets to post the job code, as well as job conditions, delays, and elapsed time. The final step to establish baseline data was to have the worker performance data sheets reviewed by the leadman and perform the necessary action to correct irregular conditions and to establish baseline data. These baseline data would later be compared with comparable data after the application of labor standards.

3.2.3 Implementation of Plan of Action

The detailed plan of action was executed as intended. The daily work sheets ***were*** completed by the workers in the Electrical Shop and were reviewed by the leadman to establish baseline data on job codes, job conditions, delays and elapsed time.

3.3 PHASE III - DETERMINE NON-PROCESS FACTOR

3.3.1 Objective

The objective of this phase was to develop non-process factors to apply to the standard times previously developed.

3.3.2 Plan of Action

Observation sampling sheets had to be devised to develop the non-process factors. Three observation sheets would be developed to obtain time samplings for Process-Value Added times (Appendix E), Process Without Value Added times (Appendix F), and Non-Process Time (Appendix G).

3.3.3 Implementation of Plan of Action

An observation sampling sheet was developed for Process-Value Added times, Process Without Value Added times, and Non-Process time. The classifications of electrical work which were outlined in the Project Conceptual Plan, as well as other electrical work

processes, were included on the observation sampling sheets.

The Process-Value Added Observation Sheet includes process times which have a direct effect on the finished product by physically changing the product configuration. On the other hand, the Process Without Value Added Observation Sheet contains process times which have an effect on the finished product, and do not add to its value. These Process Without Value Added times must be performed to support the Process-Value Added times in the manufacture of the product. Examples of Process-Value Added times include cutting and pulling cable, while examples of Process Without Value Added times may consist of measuring the cable and checking the cable route.

Delays beyond the control of the worker are bound to occur on any job. These delays represent non-process time as they involve activities performed by the electricians outside of the basic manufacturing process such as equipment breakdown and material handling delays, and which could not be properly captured as part of the labor standard under Process With and Without Value Added times. Some of these delays can be eliminated, whereas some are more difficult to handle. Those which cannot be eliminated are included as an add-on in the labor standard by means of a non-process

factor. For example, getting material and returning tools are subject to future review and reduction when productivity conditions are improved. These non-process factors are included in the Non-Process Time Observation Sheet, and must be factored into the labor standards so they can be relied upon as an accurate scheduling tool.

3.4 PHASE IV - DEVELOP LABOR STANDARD PROCESS SHEETS

3.4.1 Objective

The objective of this phase was to develop processing procedures, forms, charts, and other aids to help in the expedient application of labor standards.

3.4.2 Plan of Action

Processing procedures, forms, charts, and other aids to promote fast labor standard applications would be developed.

3.4.3 Implementation of Plan of Action

The processing procedures, forms, and charts were designed to help in the expedient application of labor standards. Some of the forms designed for this purpose were the pick off charts, and the processing sheets to record job data and source data (Appendices H through R). The processing format for establishing ***labor*** standards is simple, quick, and provides adequate accuracy for standards application.

3.5 PHASE V - IMPLEMENT COMPUTER ASSISTANCE FOR LABOR STANDARDS APPLICATION

3.5.1 Objective

The objective of this phase was to implement labor standards through the use of a computer.

3.5.2 Plan of Action

The need to implement labor standards through use of a computer was evident from the start based on PBI experience in the Pipe Fabrication Shop, and also on the knowledge that many other companies use computers for this purpose. Computer assistance was treated as a necessary part of the implementation of labor standards in the electrical area from the very beginning of this project, because the product mix would make the manual implementation of labor standards an almost impossible task.

3.5.3 Implementaticm of Plan of Action

Trial use of a personal computer was found to speed the calculations associated with establishing labor standards, but was deemed inadequate for labor standards application to production work. Computer support has aided in planning, scheduling, and manning determinations, and has provided improved management information in such areas as performance monitoring, production control, labor reporting and cost data.

3.6 PHASE VI - TRAIN PLANNERs AND SCHEDULERS

3.6.1 Objective

The objective of this phase was to train planners and schedulers in the concept, purpose, and application procedure of labor standards.

3.6.2 Plan of Action

Planners and schedulers would be given instruction in the concept and purpose of labor standards, along with the application procedure. Knowledge of the application procedure is particularly important in avoiding errors that can plague the productive process.

3.6.3 Implementation of Plan of Action

The planners and schedulers were instructed on the concept, purpose, and application of labor standards.

3.7 PHASE VII - INSTRUCT ELECTRICAL SUPERVISORS

3.7.1 Objective

The objective of this phase was to instruct electrical supervisors in the purpose of labor standards and how their application can affect the worker, the job, and overall productivity.

3.7.2 Plan of Action

In this phase as well as in Phase VI, a pilot program for the application of labor standards in a specific

area would be the means employed to show the actual application process.

3.7.3 Implementation of Plan of Action

Electrical supervisors were instructed in the purpose of labor standards and how their application can affect the worker, the job, and overall productivity. A pilot program for the application of labor standards in a specific area was used to show the actual application process. Subject matter included the validation process used by the Industrial Engineering Department to obtain accurate labor standards, how delay (non-process) conditions affect labor standards and their application, and use of the labor standards processing forms.

3.8 PHASE VIII - APPLY LABOR STANDARDS

3.8.1 Objective

The objective of this phase was to develop a system to apply allowed work hours to a work order package.

3.8.2 Plan of Action

The first step in developing a system to apply allowed work hours to a work order package would be to establish a labor standard for each job. The second step would be to group the jobs according to several conditions, such as type of work, area of work, hours to do the work, similar operations, etc. After the jobs are grouped, a title and work order number should be assigned to each

group, in addition to the appropriate job descriptions and drawing numbers. The aforementioned steps constitute the make up of a work order package.

3.8.3 Implementation of Plan of Action

Production Control and Industrial Engineering personnel cooperated closely in developing a system to apply allowed work hours to a work order package. First a labor standard was established for each job. The jobs were then grouped according to several conditions, for example, the type of work. Each group was then assigned a title and a work order number, and was provided with job descriptions and drawing numbers. This information was assembled to form a work order package. With a supply of work order packages in hand, production personnel are able to schedule the work, and assume more control of the work itself.

3.9 PHASE IX - ANALYZE VARIANCES FROM BASELINE DATA

3.9.1 Objective

The objective of this phase was to analyze variances from baseline data through a sampling study.

3.9.2 Plan of Action

In this phase, a second sampling study of baseline data would occur to investigate differences occurring after labor standards had been applied.

3.9.3 Implementation of Plan of Action

The second sample was originally intended to investigate differences occurring after labor standards had been applied. However, the delay in getting labor standards on the computer and schedule delays on the MCM contract held up their application. A second sampling will be taken when appropriate and the results will be made available to the industry through the program office at BIW.

4.0 OVERVIEW, CONCLUSIONS, AND BENEFITS

4.1 OVERVIEW

This report describes the development of labor standards during ship construction in the electrical trade area towards controlling production costs for both shop work and installation work aboard ship. The objective of this project was to improve planning, scheduling, production control, and worker productivity through the development of labor stamiards, and thereby reduce the cost of electrical work. The conceptual plan for this project involved six major tasks which outlined the general commitments that were considered necessary to provide a workable and successful program for developing labor standards. The listing that follows is a brief description of the project tasks and the project phases which were followed to fulfill the tasks.

Task A - Develop procedures, charts, and other forms for presenting labor standards information at a level of detail

suitable for use by planners and schedulers in applying labor standards to actual production work.

Phase I - Validate electrical labor standard data that were developed during the FY-81 and FY-82 MARAD research programs.

Phase II - Establish baseline data for actual working conditions prior to the application of labor standards.

Task B - Determine non-process factors in each area of concern.

Phase III - Develop non-process delay times through the use of a sampling technique.

Phase IV - Develop processing procedures and other aids to promote fast labor standard applications.

Phase V - Implement labor standards through the use of a computer to aid in planning, scheduling, and manning determinations and to provide improved management information in such areas as performance monitoring, production control, labor reporting and cost data.

Task C - Train planners and schedulers in techniques for applying labor standards.

Phase VI - Train planners and schedulers in the concept, purpose, and application procedure of labor standards.

Task D - Instruct supervisors on the purpose and application of labor standards.

Phase VII - Instruct electrical supervisors in the purpose of labor standards and how their application can affect the worker, the job, and overall productivity.

Task E - Develop a system to monitor the currentness of labor standards.

Phase VIII - Develop a system to apply allowed work hours to a work order package.

Phase IX - Analyze variances from baseline data through a sampling study.

Phase X - Monitor the productivity of workers on the job to determine performance efficiency.

Task F - Write a final report summarizing program success/ failure, productivity and cost savings attainable, and related conclusions.

The completion of these six project tasks resulted in the development of labor standards in the electrical trade area. The development of a labor standards calculation program involved the input data necessary to calculate the standards, and the actual standards calculations. The Electric Shop Calculation Model which is illustrated in Appendix S was used to organize and plan the electrical labor standards. The results of the computer program yield a true value or time estimate for a work order in the Electric Shop. These standard time estimates will be compared with the actual work order times to monitor productivity in the Electric Shop.

The Standards Entry Menu is a list of computer programs which comprise the Electrical Standards computer program. The input data that is required for the programs in the Standards Entry Menu is obtained from the existing system at Peterson Builders, Inc. The existing computerized Work Order Labor System and the Equipment Foundation System provide the

information that is fed into the Standards Entry Menu programs. The following summary explains how information from the Work Order Labor System and the Equipment Foundation System was used to develop the labor standards.

1.1 Standard Entry

Input - Standards from I.E. Dept.

Output -Cable Type/Enclosure Size Cable Standards File

Symbol Number Symbol Number Master File

Formula Value Formula Master File

1.2 Establish Work Orders

Input - Labor tracking from Work Order Cross Reference File

Output -Line Item Number Work Order Line Item File

Work Orders and Schedules Work Order Master

Update data Contract Hull Master

1.3 Cable Entry/Maintenance

Input - Line Item Number from Foundation/Equipment System

output -Line Item Number Compartment Master File

Cable Number Cable File

Line Item Number Line Item File

1.4 Standard Calculation

Input - Formula calculation from Formula Master File

Equipment identification from Symbol Number Master File

Cable identification from Cable Standards File

Estimates from Line Item File

Cable Number from Cable File

Values for miscellaneous items from Misc. File

Output -Work Order Values to Work Order Master File

Cable Number to Cable File

Standards Estimates to Line Item File

1.5 Report Module

Input - Line item number from Compartment Master File

Standard reports from Cable File and Line Item File

Work Order summary from Work Order Master File and Contract Hull Master File

output -Reports of the electrical labor standards.

The Electrical Labor Standards Calculation program contains several advantageous features. The first feature is that the work orders are broken down into phases of work. Therefore, the labor charged to a work order is divided into specific categories or phases of work instead of being included under one time estimate.

A second feature of the Standards Calculation program is that a1l electrical items and their respective locations are listed for each compartment. The computer matches two line item numbers to the same cable number, resulting in a match of both ends of the cable to their appropriate equipment. The leadman from each production system can now obtain a complete list of all the cables that will be included in a pull run from the computer rather than search through their drawing prints ***to*** check for cables used in the pull run.

The third feature of the Standards Calculation program is that the computer will have a complete listing of every electrical item in a compartment and the required installation time. This listing will promote more efficient compartment closeout since the production system leadmen can use the computer to list all the electrical items that will have to be installed by his system workers. In addition, the leadmen will obtain from the computer an approximate installation and preparation time for specific pieces of the electrical equipment.

The last feature of the Standards Calculation program is that mislabeling of cables for different ship levels on drawing prints will be decreased because the computer contains a listing of two matched line item numbers to the same cable number.

4.2 CONCLUSIONS

Several conclusions were reached during this project, as follows:

° Labor standard data needs periodic updating to accommodate changes in production procedures and equipment, some of which are subtle and may escape notice unless a formal investigation is made.

° The sampling techniques employed, in combination with the insight gained into productive work by means of labor standards, proved to be both efficient and effective in highlighting major problem areas. For example, excess manpower for cable cutting and the application of cable tags indicated a need for an

improved type of cable banding and a less expensive chafing collar.

- The classical advantages of applying labor standards to production work are important considerations for a shipyard bent on increasing productivity and improving performance. Am effective labor standards program provides improved knowledge about the productive processes, which enables direct improvements in the credibility of planning, scheduling, estimating, manpower loading, and overall performance goals.

4.3 BENEFITS

Several tangible benefits resulted directly from this project:

- Cable cutting was a two-person job until the in-house manufacture of an auto-coiler. Cutting and coiling cable is now done by one person. The toiler reels the cut cables in sequence to the way they will later be pulled through the ship. A reduction of 0.366 standard hours was the direct result. Savings are estimated to be about $1000 per ship - four ships $4,000.
- Attachment of tags to a cable was previously performed after the pulling operation as a separate step. Tags are now applied during the pulling operation. This is a reduction in manual effort. As the cable is being pulled, the worker in the pulling area has the tags with him and he attaches them to the cable. Savings are estimated at $500 per ship - four ships $2,000.

° A change was made in the type of banding used to secure cables to the hanger. The former type of banding is still used for some limited applications, with the new type of banding now constituting the bulk of the banding on the current group of ARS ships for an estimated savings on these four ships of $41,816.

° Chafing collars are welded in areas such as bulkheads where cables pass through. In-house cost to manufacture a collar is $33.5O. Whereas an equivalent collar can be purchased from a vendor for $10.31, for a savings of $20. About 400 collars per ship results in a savings of $8,000 - four ships $32,000.

° A 15-20% improvement in productivity is anticipated when labor standards are directly applied to the work. At 15% improvement for 110 workers, a dollar savings of $462,000 per year is anticipated. There are other benefits not directly tied to dollars that will do much to provide greater efficiency and control of productivity. They are:

more efficient use of worker time,

better control of labor reporting with more accurate entries,

more credible and effective scheduling of the work,

better tracking of work in progress, and

improved opportunities for more effective planning.

GLOSSARY

Actual Time - The unadjusted time for the accomplishment of a defined tasked or task element.

ARS-50 - Auxiliary Rescue/Salvage Vessel being built for the U.S. Navy a Peterson Builders, Inc.

Avoidable Delay - A delay which is under the control and responsibility of the worker. Example: wasting time, inefficient or improper work method.

Band Assembly - Metal strip with fastening clip used to secure cable runs to hangers.

Banding Cable - A method used to secure cable in cable runs with the use of a worm type hose clamp or metal strapping.

Baseline Data - For the purpose of this report, baseline time data will refer to the current efficiency rate and performance level of the Electric Shop's output.

Daily Work Sheet - A form designed for electrical workers to fill out listing jobs accomplished and the time to complete the jobs during a shift.

E-Time - Is a phase used to describe work done due to an engineering change. The worker charges his time to this class of work on all work he performs on an engineering change.

Efficiency Rate - The ratio of standard performance time to actual performance time.

Equipment Preparation - The process where stuffing tubes are installed in electrical equipment to facilitate cable entry.

Estimated Time - An element or operation time that has been predicted on the basis of such information as may be available.

Hook UP - The process of hooking the cable leads to termination points in electrical equipment.

I.D. Tag - Metal strip with characters punched into it for identification. These tags are attached to the cable in the ship wherever the cable passes through a deck or bulkhead and terminates at a piece of electrical equipment.

Labor Standard - A standard time set on a direct labor operation.

Labor Standards - A combination of standard data set up in an organized pattern to cover work content.

MCM - Mine Countermeasure Vessel; a Prototype presently under construction at Peterson Builders, Inc.

MCT - Multiple cable transit; a modular system which will provide watertight, airtight and fireproof bulkhead and deck penetrations.

MOST - Maynard Operational Sequence Technique. A predetermined time study technique.

Non-process Time - The time spent by the electricians while engaged in activities outside of the basic manufacturing process that could nc be properly captured as part of the labor standard (personal time, waiting for material, reading work instructions, equipment breakdown, delays, etc.).

Non-process Factor - A factor developed to take into account the real, natural and acceptable differences between level times and actual time for accomplishing work. The magnitude of the non-process factor is ba on a work sampling conducted at the work place.

Packing MCT - The process of filling the MCT with components around the cables which pass through it to make it water and air tight.

Performance Level - The ratio of a performance standard established for a certain quantity of work to the performance actually achieved.

PFD - allowance made up of personal, fatigue and delay times.

Pickoff Sheets - A form listing all electrical standards on all electrical components. The pickoff sheet is used in conjunction with the process sheets.

Shooting Studs - The process of using a special welding gun which welds studs to bulkheads. These studs are used in local cable runs.

Standard Data - A set of synthesized time values established using the MOST technique.

Standard Electrical Symbol List - A book published by NAVSEA which contains standard electrical and electronic equipment covered by specifications, military standards and drawings.

Standard Time - A unit time value for the accomplishment of a work task as determined by the proper application of appropriate work measurement techniques.

Studs - A solid metal rod threaded on one end, used to fasten cable clips on.

Time Study - A work measurement technique consisting of careful time measurement of a task with time measuring instruments, adjusted for any observed variance from effort or pace.

Unavoidable Delay - a delay which is outside the control ***or*** responsibility of the worker. Example: equipment breakdown, looking for material.

Validating - The process we went through to substantiate and verify our electrical standards.

Value Analysis - Review of product costs to evaluate contribution to product value.

Work Order - Document used at PBI to describe a package of electrical work.

Work Order Package - A group of documents used at PBI to convey authority for the manufacture of specified electrical equipment and/or electrical operations in specific locations. The work order also includes all related prints and a list of material required to complete the defined work.

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D	Daily Work Sheet - Lighting System
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F	Process-Without Value Added Observation Sheet
G	Non-Process Observation Sheet
H	Leadman Cable Pull List (Used as Cutting List)
I	Information Required to Set Standards on Work
J	Cable Labor Standards Process Sheet
K	Cable Labor Standards Pick Off Process Sheet
L	Miscellaneous Labor Standards Process Sheet I
M	Equipment Labor Standards Process Sheet
N	Cable Hook Up Pick Off Sheet
N-1	Cable Hook Up Pick Off Sheet
o	Equipment Labor Standards Process Sheet - Source Data - Symbol List
P	Miscellaneous Labor Standards Process Sheet II
Q	Electrical Department Standards Sheet from Personal Computer
R	Electrical Shop Equipment Take Off Sheet
S	Electric Shop Calculation Model

APPENDIX A

DAILY WORK SHEET: CABLE PROCESSING

DAILY WORK SHEET
ELECTRIC DEPT 17
CABLE PROCESSING

EMP#________

DATE________

HULL	PULL #	WORKING TIME	WORK CLASS	RE-WORK	"E"	DELAYS	COMMENTS

WORK CLASSIFICATION
1)CUTTING 2)MAKING TAGS 3)PULLING

APPENDIX B

DAILY WORK SHEET: EQUIPMENT PROCESSING

DAILY WORK SHEET

ELECTRIC DEPT 17
EQUIP. PROCESSING

EMP#________
DATE________

HULL	LINE ITEM	TIME CHARGE	WORK CLASS	RE-WORK	"E"	DELAYS	COMMENTS

WORK CLASSIFICATION
1)EQUIP. PREP. 2)MOUNTING 3)HOOKUP

APPENDIX C

DAILY WORK SHEET:
LOCAL CABLES AND PACKING MCT'S

DAILY WORK SHEET
ELECTRIC DEPT 17
LOCAL CABLES &
PACKING MCT'S

EMP#________
DATE________

HULL	LOCATION OR MCT #	TIME CHARGE	WORK CLASS	RE-WORK	"E"	DELAYS	COMMENTS

WORK CLASSIFICATION
1)CUTTING 2)MAKING TAGS 3)INSTALLING 4)BANDING 5)PACKING

APPENDIX D

DAILY WORK SHEET: LIGHTING SYSTEM

DAILY WORK SHEET
ELECTRIC DEPT 17
LIGHTING SYSTEM

EMP#________
DATE________

HULL	WORKING TIME	LOCATION OR COMP.	WORK CLASS	RE-WORK	"E"	DELAYS	COMMENTS

WORK CLASSIFICATION
1)EQUIP. PREP. 2)MOUNTING 3)HOOKUP

PROCESS-VALUE ADDED OBSERVATION SHEET

F. R. 2163 | FILE | ENG. | DATE | SHEET

ELECTRIC SHOP

TIME OF OBSERVATION

ANALYSIS FORM PROCESS-VALUE ADDED														
1	CUTTING CABLE													
2	MARKING CABLE													
3	CUTTING CABLE													
4														
5														
6	PULLING CABLE													
7	INSTALL TAGS													
8	PULLING													
9														
10														
11	BANDING													
12														
13														
14														
15														
16	MAKING ID TAGS													
17														
18														
19														
20														
21	EQUIP PREP													
22	DRILLING													
23	PUNCHING													
24	INSTALL STUFF													
25	TUBE													
26	MOUNTING													
27	DRILLING													
28	BOLTING													
29														
30														
31	HOOKUP													
32	CABLE PREP													
33	MARKING													
34	TERMINATING													
35														
36	PACKING MCT													
37	FITTING INSERTS													
38	APPLY MTV													
39	INSTALL STAY-PLATE													
40	END PACKING													
41														
42	SHOOTING STUDS													
43	WELDING													
PFD 44														
45	PERSONAL													
46														
47														

APPENDIX E

PROCESS-WITHOUT VALUE ADDED OBSERVATION SHEET

F. R. 3163

	FILE
	ENG.
ELECTRIC SHOP	DATE / SHEET
TIME OF OBSERVATION	

ANALYSIS FORM PROCESS WITHOUT VALUE ADDED													
1 CUTTING CABLE													
2 MAKE UP ID TAGS													
3 MEASURE CABLE													
4 REEL UP TO STORE													
5													
6 PULLING CABLE													
7 REEL UP EXCESS													
8 CHECK CABLE ROUTE													
9 TIE WRAPING													
10													
11 BANDING													
12 ARRANGE CABLE													
13 POSITION FOR NEXT													
14 BAND													
15													
16 MAKING ID TAGS													
17 LOAD & UNLOAD													
18 READY FOR STORAGE													
19													
20													
21 EQUIP PREP													
22 LAYOUT													
23 SET UP & TEAR DOWN													
24													
25													
26 MOUNTING													
27 LAYOUT													
28 POSITIONING													
29													
30													
31 HOOKUP													
32 LAYOUT													
33 TRUNCKING													
34													
25													
35 PACKING MCT													
37 LAYOUT													
38 ARRANGE CABLE													
39													
40													
41													
42 SHOOTING STUDS													
43 REMOVE INSULATION													
44 GRIND PAINT													
PFD 45													
46 PERSONAL													
47													

APPENDIX F

NON-PROCESS OBSERVATION SHEET

F. R. 2M3

FILE

ENG.

ELECTRIC SHOP

DATE SHEET

TIME OF OBSERVATION

	ANALYSIS FORM NON-PROCESS TIME														
1	PERSONAL TOOLS														
2	MOVING IN BOAT														
3	PERSONAL														
4	DISCUSSION W/SUPT														
5	RETURNING TOOLS														
6	LEAVING BOAT														
7	UARCO														
8	DISCUSSION														
9	GETTING MATL														
10	RETURNING TO														
11	BOAT W/OUT MATL														
12	READING PRINT														
13	CLEAN UP														
14	IDLE														
15															
16															
17															
18															
19															
20															
21															
22															
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44															
45															
46															
47															

APPENDIX G

APPENDIX H

LEADMAN CABLE PULL LIST

CABLE LABOR STANDARD PROCESS SHEET - SOURCE DATA-USED AS CUTTING LIST

CABLE PULL NO. 1 (Cont.)

CABLE NO.	DWG. NO.	NO. OF TAGS	TYPE-SIZE	LENGTH	REEL NO.	REMARKS
(J1P)-4P-C(1) (L691)-4P-C(1)	320-055	10	TSGU - 4 ✓	195	3034	MARK 50'
K-TW193	320-073	12	DSGU - 4 ✓	161	2981	60'
K-TW194	"	12	DSGU - 4 ✓	161	2981	60'
K-TW195	"	12	DSGU - 4 ✓	161	2981	60'
K-TW196	"	12	DSGU - 4 ✓	161	2981	60
K-TW220	"	12	TSGU - 4 ✓	146	3034	47'
K-TW189	"	12	FSGU - 4 ✓	148	3013	47'
K-TW190	"	12	FSGU - 4 ✓	148	3013	47
K-TW191	"	12	FSGU - 4 ✓	148	3053	47
K-TW192	"	12	FSGU - 4 ✓	148	3053	47'
K-TW212	"	12	7SGU - 4 ✓	159	3031	60
K-TW213	"	12	7SGU - 4 ✓	159	3031	47'
K-TW214	"	12	7SGU - 4 ✓	159	3031	47'
K-TW215	"	12	7SGU - 4 ✓	159	3031	47
K-TW216	"	12	7SGU - 4 ✓	159	3031	47
K-TW217	"	12	7SGU - 4 ✓	159	3031	47
K-TW218	"	12	7SGU - 4 ✓	159	3031	47
[illegible]	"	[illegible]	7SGU - 4 ✓	[illegible]	[illegible]	47

INFORMATION -REQUIRED TO SET STANDARDS ON WORK

INFORMATION REQUIRED TO:

1. CUT CABLE= Cable ID #, length of cable, cable type, reel #, and mark ends for stop pull.

2. PULL CABLE Cable ID #, length of cable, starting location, ending location, drawing #, and cable route.

3. Band Cable = Cable ID #, hanger location, tier # of bands required, routing drawing, starting location, ending location, special info.

4. Make Tags = Cable ID #, cable type and # of tags.

5. Pack MCT = MCT ID #, cable ID #, cable type, MCT location, drawing #, MCI components size, quantity requirenments and miscellaneous parts.

6. INSTALL LOCAL= Assembly or compartment #, cable ID # , cable type, lengths, starting locatlon, ending location, drawing #, approximate location, # of tags required, equipment the wire terminates at and Studs .

7. EQUIP PREP = Cable ID #, cable type, drawing #, stuftting tube quantity and size, location of stuffting tube, vendor print, mist cares needed, stuffing tube type and special info.

8. MOUNTING EQUIP=DRAWING # , assenbly or comparment #, approximte location. location of equipment (layout) , vendor print, misc pares needed (nuts & bolts) , template with bolt holes (to eliminate the need to take the box cut) and foundation.

9. HOCKUP CABLES= cable ID # , cable type, equipment #, equipment location, assembly or component #, drawing # , hookup drawing #, stuffing tube size and identification, vendor print , misc parts, spaghetti, local cable requirements, local mounting information.

10. TEST CABLES = Test (meg/ring) requirments, cabie ID #, cable type, starting location, ending location, drawing #, assembly or compartment #, approximent: location, vendor prints, hookup drawing #.

CABLE LABOR STANDARDS PROCESS SHEET

CABLE PULL # ____
DATE ____

CABLE LABOR STANDARD PROCESS SHEET

ELECTRIC DEPT. ______

ITEM DESCRIPTION ________________________________

____

JOB DESCRIPTION ________________________________

____

PICK OFF CHARTS-ALL TIMES IN STANDARD HOURS
(INCLUDES 15% PFD)

A CABLE#	B DWG#	C TYPE	D FLAGS	WORK ORDER # ____ 1. RATE MAKE-UP	WORK ORDER # ____ 2. RATE INSTALL	E LENGTH	WORK ORDER # ____ 3. CUTTING TO 3/4 >	WORK ORDER # ____ 4.* PULLING TO 3/4 >	WORK ORD... 5. BAND...
			SUB TOTAL			SUB TOTAL			
per 8 hour shift				÷8	÷8		÷8	÷8	÷(
# of set ups X set up time				*.55	*.55		*.103	*.94	*.5
WORK ORDER # ________			SUB TOTAL	+	+	SUB TOTAL	+	+	+
			TOTAL			TOTAL			

CABLE LABOR STANDARDS PICK OFF PROCESS SHEET

CABLE STANDARDS PICK OFF CHARTS

CUTTING CABLE

LENGTH OF CABLE	STANDARD	LENGTH OF CABLE	STANDARD	LENGTH OF CABLE	STANDARD
10	.07	160	.26	310	.46
20	.08	170	.28	320	.47
30	.09	180	.29	330	.48
40	.10	190	.30	340	.49
50	.12	200	.32	350	.51
60	.13	210	.33	360	.52
70	.14	220	.34	370	.54
80	.16	230	.36	380	.55
90	.17	240	.37	390	.56
100	.18	250	.38	400	.58
110	.2	260	.40	410	.59
120	.21	270	.41	420	.60
130	.22	280	.42	430	.62
140	.24	290	.43	440	.63
150	.25	300	.45	450	.64

NOTES:

ALL CABLE LENGTH IN FEET

SET UP TIME

.103 HRS./SHIFT

FORMULA USED TO CALCULATE STANDARDS

x=.057+[CABLE LENGTH(.013)]

PICKOFF CHART FOR PULLING CABLES

SETUP TIMES

.118 HRS*(8 MEN)/SHIFT=.94 HRS./SHIFT

FORMULA USED TO CALCULATE PULL STANDARDS

UP TO .750" O.D. Y=(.0017(X)/10+.005(X/15)+.03(X/20)+.096)8

<THAN .750" O.D. Y=(.0034(X)/10+.005(X/15)+.03(X/20)+.192)8

LENGHT IN FEET

	DIA. <.749	DIA. >.750		DIA. <.749	DIA. >.750		DIA. <.749	DIA. >.750
10	1.92	1.71	160	3.33	4.31	310	5.74	6.92
20	1.08	1.85	170	3.49	4.49	320	5.90	7.10
30	1.25	2.05	180	3.65	4.66	330	6.06	7.27
40	1.41	2.23	190	3.81	4.89	340	6.22	7.44
50	1.57	2.40	200	3.97	5.01	350	6.38	7.61
60	1.73	2.57	210	4.31	5.18	360	6.54	7.79
70	1.89	2.75	220	4.29	5.36	370	6.70	7.96
80	2.05	2.92	230	4.46	5.53	380	6.86	8.14
90	2.21	3.1[illegible]	240	4.62	5.70	390	7.02	8.[illegible]
100	2.37	3.2[illegible]	250	4.78	5.85	400	7.[illegible]	8.49
110	2.53	3.44	260	4.49	6.05	410	7.34	8.66
120	2.69	3.62	270	5.10	6.23	420	7.50	8.38
130	2.85	3.74	280	5.25	6.40	430	7.67	9.01
140	3.01	3.9[illegible]	290	5.42	6.5[illegible]	440	7.83	9.18
150	3.17	4.14	300	5.58	6.75	450	7.99	9.36

BANDING CABLES

LENGTH OF CABLE	# OF BANDS	LENGTH OF CABLE	# OF BANDS	LENGTH OF CABLE	# OF BANDS	LENGTH OF CABLE	# OF BANDS
10	[illegible]	110	5	210	10	310	14
20	1	120	5	220	10	320	15
30	1	130	6	230	10	330	15
40	2	140	6	240	11	340	15
50	2	150	7	250	11	350	16
60	3	160	7	260	12	360	16
70	3	170	8	270	12	370	17
80	4	180	8	280	13	380	17
90	4	190	9	290	134	390	18
100	5	200	9	300	14	[illegible]	[illegible]

NOTES:

SET UP TIME
.55 HRS/SHIFT

TIME / BAND .16 HRS

MISCELLANEOUS LABOR STANDARDS PROCESS SHEET I

MAKING I . D . TAGS

NOTE :

EST. THAT THERE IS ONE TAG FOR EVERY 15' OF CABLE
SET UP TIME .278 HRS/SHIFT
TIME PER TAG- .03 HRS.

EQUIPMENT PREPARATION

NOTE :

SET UP TIME .38 HRS/SHIFT

TIME/NYLON STUFFING TUBE	.22 HRS.
TIME/BRASS STUFFING TUBE	.35 HRS.
TIME/NIPPLE	.40 HRS.
TIME/KICK PIPE	.28 HRS

MOUNTING ELECTRICAL EQUIPMENT

NOTE:

SET UP TIME .59 HRS/SHIFT
REFER TO STANDARD ELECTRICAL SYMBOL LIST
REFER TO PICK OFF CHART

HOOKING UP CABLE

NOTE:

SET UP TIME .59 HRS/SHIFT
REFER TO CABLE HOOK UP PICKOFF SHEET

EQUIPMENT LAEOR STANDARDS PROCESS SHEET

PBI DWG. # ______
SYM. # ______

QUIPMENT LABOR
STANDARD PROCESS SHEET

ELECTRI DEPT. ______ LOCATION ______

ITEM DESCRIPTION ______

JOB DESCRIPTION ______

PICK OFF CHARTS-ALL TIMES IN STANDARD HOURS (INCLUDES 15% PFD)

WORK ORDER #

CABLE HOOKUP TERMINATION			
TYPE	TIME	QTY.	TOTAL

WORK ORDER #

EQUIPMENjT PREP.			
1	.35	2	.45
3	.60	4	.70
5	.80	6	.95
7	1.05	8	1.2
9	1.3	10	1.4
11	1.55	12	1.&5

WORK ORDER #

MOUNTING EQUIP.

EOUIP. CODE
SIZE ______

TIME FROM SYMB0L BOOK

QTY.TOTAL					
SUB TOTAL					
Per 8 hour shift	÷8		÷8		÷8
#of set ups X set up time	*.59	TOTAL	*.59	TOTAL	*.59 TOTAL
SUB TOTAL.	+		+		+

APPENDIX M

CABLE HOOK UP PICK OFF SHEET

CABLE HOOKUP PICKOFF SHEET

CODE SIZE / CABLE TYPE	SIZE ENCLOSURE SMALL		LARGE		SIZE ENCLOSURE SMALL	MEDUIM	LARGE
DNW-3 THRU 23	.2A	-82	1.54	3SWU- I	I .02	1.87	3.06
TNW-3 THRU 23	.33	1-12	2-11	3SWU-7	2.28	4. 17	6.84
FNW-3 THRU 23	.41	I -29	2.62	3SWU- I 0	3.22	5.89	9.66
NNW-7	.71	2.41	4.54	3SWU- 1 4	4.47	8.18	13.4I
MNw-I0	.98	3.33	6.27	3SWU- 19	6.00	10.98	18.00
MNW-IA	1 .33	4.52	8.51	3SWU-24	7.60	13.91	22.80
brew- I 9	1.78	6.05	11.39	2SWU- 1	.34	.82	1.01
MNU-24	2.22	7.55	14.21	2SWU3	.54	1 .68	1.94
MNW-30	2.76	9.38	17.66	2SWU-7	1.64	3.28	5.90
MNW-37	3.38	11.49	21.63	2SWU- 1 2	2.21	4.42	7.06
MNW-44	4.00	13.06	25.60	2SMU- 1 4	3.21	6.42	11.56
DSGU-50 THRU 4OO	.44L	2.44	5.36	23WU- 19	4.32	8.64	15.55
TSGU-50 THRU 4OO	.56	3.12	6.82	2SMU-24	5.44	10.88	19.58
				2SWU-30	6.76	13.56	24.41
DSGU-3 THRU 23	.22	1.22	2.68				
TSGU-3 THRU 23	. 28	1.56	3.41	3SU-3	.88	I .58	4.45
FSGJ-3 THRU 23	.34	1.89	4.14	3SU-7	1 .97	3.55	5.52
7SGU-3bA		2.84	6.21	3SU-10	2-77	4.99	7.76
6SGU-100 THRU 200;	.83	5.68	12.42	3SU- I 4	3.85	6.93	10.78
	!			3SU-19	5.19	9.34	14.53
!SWU-2	.28	.51	. 84	3SU-24	6.33	11l .75	18.28
i SMU- I 4	.94	1.72	2.82	3SU-30	7.90	14.22	22.12
ISWU-20	1.27	2.32	3.81				
				TTSU&TTNW-I 1/2	.33	I .22	2.31
2SMUI& 2SWSU-7	1.89	3.46	5.67	TTSU&TTNW-3	.57	2.11	3.99
2SWAU-10	2-67	5.36	9.08	TTSU&TTNW-5	.88	3.26	6.16
2SWAU-12	3.19	5.80	9.57	TTSU&TTNW-10	1.71	6.33	11.97
2Sh'U &2SWAU-19	5.00	9.15	15. OC	TTSU&TTNW-15	2.52	9.32	17.64
2SWU &.2SWAU-2U	6.30	11.53	18. 40	TTSU&TTNW-30	3.32	12.28	23. 24
2SWU & 2SWAU-37	9.67	19.43	32-88	MDU-6 THRU 30	2.76	5.54	12.56
				MDU-30 THRU 60	3.75	7.84	16.43

CABLE HOOK UP PICK OFF SHEET

CABLE HOOKUP PICKOFF SHEET

	SIZE ENCLOSURE				SIZE ENCLOSURE		
CODE SIZE	SMALL	MEDUIM	LARGE		SMALL	MEDUIM	LARGE
CABLE TYPE							
MSCU-3	.32	.98	1.44				
MSCU-7	.63	2.0	2.98				
MSCU-10	.86	2.84	4.13				
MSCU-14	1.18	3.901	5.67				
MSCU-19	1.57	5.23	7.59				
MSCU-24	1.96	6.56	9.51				
MSCU-30	2.42	8.15	11.81				
MSCU-37	2.97	10.01	14.50				
MSCU-44	3.52	11.88	17.19				

EQUIPMENT LABOR STANDARD PROCESS SHEET - SOURCE DATA

STANDARD ELECTRICAL

SYMBOL LIST

SIZE	STD	SYM. NO.	ITEM	STD DWG & SPEC	STOCK NO.	WT
		713(100)	Cable assembly, 125V, 10A, SDM-4000, 3 Cond., TSS-4 cable, 100 ft length	MIL-C-24231/1	9G6150-00-681-8380	•
		713.1	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (7 Cond.)	MIL-C-24231/3	1H5935-00-706-9360	16.0
		713.1(90)	Cable Assembly, 125V-10A, SDM-4000 (7 Cond.) FSS-2 Cable	MIL-C-24231/3 -001	1H5995-00-070-9489	13.5
		713.1(100)	Cable Assembly, 125V-10A, SDM-4000 (7 Cond.) 2 SW-3 Cable	MIL-C-24231/3 -001	1H5995-00-070-9512	•
		713.2	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (14 Cond.)	MIL-C-24231/4 -001	1H5935-00-705-1665	•
		713.3	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (24 Cond.)	MIL-C-24231/4 -002	1H5935-00-064-2036	•
		713.4	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (30 Cond.)	MIL-C-24231/4 -003	1H5935-00-064-2038	•
		713.5	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (3 Cond.) (90°)	MIL-C-24231/2 -001		
		713.6	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (4 Cond.)	MIL-C-24231/1 -002		•
		713.7	Molded Plug Kit, 300V-6A, 125V-10A, SDM-400 (9 Cond.)	MIL-C-24231/3 -002	1H5935-00-064-2037	•
		713.8	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (4 cond.) (90°)	MIL-C-24231/2 -002		•
		713.9	Molded Plug Kit, 300V-6A, 125V-10A, SDM-4000 (3112 Cond.)	MIL-C-24231/23 -001		•
		713.10	Molded Plug, 300V-6A, 125V-10A, SDM-4000, (40 Cond.)	MIL-C-24231/4		•
		713.11	Epoxy splice kit, for DSS-3 cable	803-1197255	1H5995-00-657-6313	•
		714	Obsolete 5428-L		5.5	
		715	Superseded by Sym. No. 715.1	S6202-73002		
		715.1	Plug, UP - 40A-125V DC Male	MIL-R-2726/1	9H5935-00-170-3061	0.5
		716	Superseded by Sym. No. 716.1	S6202-73082		
		716.1	Plug, 30 - 50A-250V-DC - male	MIL-R-2726/2	1H5935-00-052-4199	0.5
		717	Superseded by Sym. No. 717.1	S6202-73002		
		717.1	Plug, 4P-40A-450V AC Male	MIL-R-2726/3	9H5935-00-935-2235	0.5
		718	Superseded by Sym. No. 718.1	S6202-73802		
		718.1	Plug, 12P-5A-125V DC	MIL-R-2726/4		0.5
		720	Superseded by Sym. No. 720.3	MS17791		
		720.1	Superseded by Sym. No. 720.3	MS17791		
		720.2	Superseded by Sym. No. 720.3	MS17791		

MISCELLANEOUS LABOR STANDARDS PROCESS SHEET II

PBI DWG. # ________

MISC. LABOR STANDARD PROCESS SHEET II

ELECTRIC DEPT. ______ LOCATION ________________

ITEM DESCRIPTION ________________________________

JOB DESCRIPTION ________________________________

PICK OFF CHARTS—ALL TIMES IN STANDARD HOURS (INCLUDES 15% PFD)

W.O. # ____________________ W.O. # ____________________

Set-up .44 hrs | Set-up .75 hrs

*PACKING MCT	*SHOOTING STUDS
MCT # ________ LOCATION ________ # OF CABLES ________	COMPARTMENT ________ DWG # ________ # OF STUDS ________
Time/MCT .120 HRS X ____ = ____ Time/Cable .065 HRS X ____ = ____ Time/Blank .023 HRS X ____ = ____ Time/Fume Tight 1.75 HRS X ____ = ____	Time/STUD .05 HRS X ____ = ____

Sub Total			
Per 8 Hour Shift	÷8		÷8
# of set-ups X set-up time	*.44		*.75
Sub Total	+		+
Total			

APPENDIX Q

ELECTRICAL DEPARTMENT STANDARDS SHEET FROM PERSONAL COMPUTER

ELECTRIC DEPARTMENT STANDARDS SHEET

file name: ________ contract # ________ hull number: ________ Report Date: 01-Jun-84

elect dwg number: ________ rev. number: ________ ecn number: ________ compartment (zone): ________

item symbol no: ________ equipment: ________ item number: ________ l/a weight: ________

additional info: ________ block note # ________ fur. dwg. # ________

Stds To Be Calc'd:Yes(1),No(0)

Cutting ___ Prep ___

Pulling ___ Mount ___

Banding ___ Hookup ___

Tags ___

Equipment Mounting Weight (lbs): ________
*If N.A.(0)
*Less than 30 (1)
*Greater than 30 and less than 60 (2)
*Greater than 60 (3)

No. of Cables: 0

Cable Type	Cable O.D (N.A.(0) <3/4"=(1) >3/4"=(2)	Quantity	Cable Length	Total Cable Length	Cutting Cable	Pulling Cable	Banding	Tags	Equip Prep	Mounting Equipment (one time covers equipment)	Hookup/ Cable	Total Hookup
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00
				0.00	0.00	0.00	0.00	0.00	0.00			0.00

	Cutting Cable	Pulling Cable	Banding	Tags	Equip Prep	Mounting Equipment	Total Hookup
Totals:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-Process Time:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted Non-Process:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Set-up Time:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted Set-up:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adj Two Cable Factor:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX R

ELECTRICAL SHOP EQUIPMENT TAKE OFF SHEET

ELECTRIC SHOP EQUIPMENT TAKE-OFF SHEET

DWG ______________________ REV ________ ECN ________ DATE ____________ SHEET ________

COMPARTMENT	SYMBOL #	EQUIPMENT	SPECIAL INFORMATION	ITEM	FINISH. DWG #	WT	BLOCK NOTE ITEM	CABLE #	CABLE TYPE	CABLE LENGTH

ELECTRIC SHOP CALCULATION MODEL